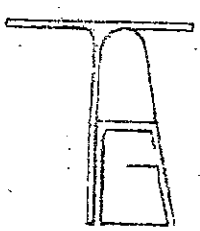

DOUG McKAY

Technical Associates Group, Inc.

H V A C SYSTEMS ANALYSIS & BALANCING

19th floor meeting 8/99

AUGUST 11, 1999

PROJECT

25 SIGOURNEY STREET
HARTFORD, CONNECTICUT

NINETEENTH FLOOR
VARIABLE AIR VOLUME BOX STUDY
CERTIFIED REPORT

OWNER
Tunxis Management Company
25 Sigourney Street
Hartford, CT 06106
Phone: (860) 951-4004
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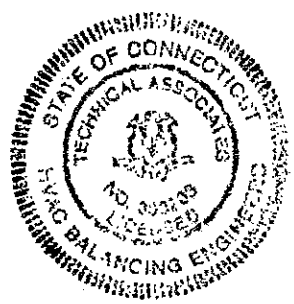
Ms. Vibha J. Buckingham



MEMBER NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

P. O. Box 1924 Wallingford, CT 06492 (203) 294-1820 FAX (203) 294-1401

25 Sigourney Street
Hartford, CT
Nineteenth Floor Variable Air Volume Box Study

August 11,1999

SPECIFIC COMMENTS

INTRODUCTION

Pursuant to the request of the Tunxis Management Company, we have been contracted to perform survey work on the 19th floor of the Sigourney Street facility. Specifically our survey work involved the variable air volume (VAV) boxes associated to the two core air-handling units serving this floor. The issue that precipitated this request was extreme hot and cold spots being experienced throughout the floor by the occupants.

OBSERVATIONS & FINDINGS

There are forty-three VAV boxes serving this floor that are all Trane pressure independent type boxes with pneumatic volume regulators for minimum and maximum airflow control. Each box is operated off a pneumatic wall-mounted thermostat located in the area served. The airflow for the VAV boxes is supplied by two separate air handlers, which are connected together with a common supply duct. The supply duct static pressure for these air handlers is controlled through two separate variable frequency drives (VFD) that vary fan motor performance as the VAV boxes modulate open and closed. The perimeter offices are served by fan powered heating VAV boxes that draw airflow from the return air plenum associated to the core systems.

Immediately a few specific issues were identified with many of the boxes. Specifically the airflow regulators for the VAV boxes that we checked were found to be severely out of calibration. We found that even when the thermostats associated to the VAV boxes were satisfied, a majority of the boxes remained in a full open position. With the boxes in a full open position, there would be severe cold spots for the occupants in those areas. Reverse to this situation, our Technicians found some of the VAV boxes that would not open at all were causing an extremely warm condition for the occupants in that area.

Beyond these situations, we found that the VFD controllers for the air handlers were not maintaining proper duct pressure resulting in inconsistent and in most cases, insufficient duct static pressure throughout the floor. This low static pressure interprets into low airflow at the VAV boxes. It was additionally noted that to get proper airflow throughout the floor, the entire system needed to operate under a

diversity factor of 29%. Under this premise, a portion of the VAV boxes on this floor will always be satisfied essentially in a minimum airflow position. In this condition, the VFD controllers would still be operating at 100% until a greater percentage of VAV boxes are satisfied. With the operating condition of many of the VAV boxes not closing, the areas that require cooling will never get satisfied because the VAV boxes serving these areas will never get the proper inlet static pressure.

The final area of issues was found with the thermostats and regulators themselves. Our Technicians did find that some of the thermostats and regulators were bad and did need replacing. Hence it was our recommendation to set up and recalibrate all the VAV boxes for the minimum and maximum airflow set points.

CONCLUSIONS & RECOMMENDATIONS

The scope of this phase of work was limited to testing and adjusting the VAV boxes associated with this floor. However, it should be noted that our procedures were discussed with building management and it was decided that we (TAG, Inc.) would not include any actual air outlet balancing. Additionally, it was decided that any work associated to the air-handling units and the VFD controllers would be done by building management personnel. Also, as directed by Building Management, all the box minimums were set to 20% of the maximum CFM requirement.

As a reminder, the design of this system has a 29% diversity built into it. So as to simulate this diversity, TAG Technicians closed off a portion of the VAV boxes and balanced the remaining open boxes to design. Once the open boxes were balanced, this condition was flip-flopped by opening the previously closed boxes and closing the previously open boxes and balance accordingly. Hence, the enclosed actual readings reflect the diversity in affect. Also, in some isolated situations, TAG Technicians had to actually exceed the 29% diversity so as to achieve the minimum / maximum settings for those boxes. While working the system under the diversity, the VFD was placed in a manual mode and put at 60 hertz for maximum fan performance. It was in this phase of work that our Technicians replaced any bad regulators or thermostats as identified. Overall the minimum and maximum settings for all the boxes were achieved except were noted below. The exceptions are as follows:

- Box 19-1: We had difficulty getting a good inlet static pressure for the box in the maximum mode. As a result, this box is low on actual CFM in the max setting. No issues were identified with the set up of the minimum mode.
- Box 19-7: The fourth outlet off this box has a torn flex, causing air leakage. This should be repaired.

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- Box 19-18: The return air plenum for the back of the box is falling off and should be repaired. Also this box is missing its' filter.
- Box 19-19: This box had a bad regulator, and was changed accordingly. However, even with a new regulator we could not achieve the airflow for the maximum setting. No problems were identified with the minimum setting.
- Box 19-21: We could not achieve the proper setting for the minimum mode.
- Box 19-35: This box serves an office area and a secured budget file room. The outlet located in the file room is closed off 100%.
- Box 19-38: We could not achieve the maximum setting for this box. Also, it should be noted that the per outlet total exceeds the nominal CFM for this box.

At the completion of our balancing efforts, the VFD was returned to the auto position. However, we found the VFD to still not be tracking properly. It would be our recommendation to correct the tracking and get it to work properly.

As a final observation, it would be our recommendation to have the minimum and maximum settings for these VAV Boxes calibrated every two years so as to ensure the proper operation of the system.

Technical Associates Group, Inc.

HVAC SYSTEMS ANALYSIS AND BALANCING

Project: 25 SIGOURNEY STREET - 19TH FLOOR

Location: HARTFORD, CONNECTICUT

JULY 20,1999

VARIABLE AIR VOLUME BOX CALIBRATION DATA

VAV BOX NAMEPLATE DATA				INLET FLOW SENSOR / MINIMUM			INLET FLOW SENSOR / MAXIMUM		
VAV TAG	FLOOR SERVED	BOX SIZE	INLET SIZE	SENSOR READING	DESIGN CFM	ACTUAL CFM	SENSOR READING	DESIGN CFM	ACTUAL CFM
19-1	19TH	08	8"Ø	0.035"	165	150	0.40"	825	550
19-2	"	04	6"Ø	0.03"	70	70	0.65"	350	375
19-3	"	08	8"Ø	0.031"	160	140	0.62"	800	750
19-4	"	08	8"Ø	0.035"	120	110	0.40"	590	550
19-5	"	08	8"Ø	0.03"	100	85	0.25"	490	425
19-6	"	17	10"Ø	0.08"	220	230	0.50"	1100	1025
19-7	"	17	10"Ø	0.042"	310	300	0.95"	1550	1400
19-8	"	04	6"Ø	0.03"	50	60	0.30"	250	250
19-9	"	24	12"Ø	0.025"	340	340	0.55"	1680	1550
19-10	"	24	12"Ø	0.03"	295	295	0.70"	1475	1450
19-11	"	04	6"Ø	0.015"	80	90	0.62"	400	380
19-12	"	17	10"Ø	0.045"	340	310	1.30"	1700	1625
19-13	"	04	6"Ø	0.025"	80	80	0.65"	400	390
19-14	"	04	6"Ø	0.03"	90	90	0.70"	440	400
19-15	"	17	10"Ø	0.04"	310	300	0.85"	1550	1450
19-16	"	17	10"Ø	0.01"	170	200	0.30"	850	800
19-17	"	11	8"Ø	0.03"	150	150	0.55"	740	690
19-18	"	08	8"Ø	0.03"	90	95	0.25"	450	440
19-19	"	17	10"Ø	0.055"	340	350	0.10"	1655	450
19-20	"	04	6"Ø	0.03"	85	80	0.70"	410	385
19-21	"	08	8"Ø	[1]	130	[1]	0.55"	630	650
19-22	"	08	8"Ø	0.05"	140	160	0.41"	700	680
19-23	"	11	8"Ø	0.05"	205	200	0.85"	1020	940
19-24	"	11	6"Ø	0.06"	120	120	1.15"	600	555
19-25	"	04	8"Ø	0.02"	110	115	0.40"	540	550
19-26	"	08	8"Ø	0.03"	140	140	0.50"	690	650
19-27	"	06	6"Ø	0.06"	120	120	1.20"	600	545
19-28	"	04	6"Ø	0.06"	80	120	0.85"	400	400
19-29	"	08	8"Ø	0.03"	160	70	0.68"	805	770
19-30	"	04	6"Ø	0.03"	70	80	0.55"	350	340
19-31	"	04	6"Ø	0.03"	85	80	0.70"	420	350
19-32	"	17	10"Ø	0.03"	240	250	0.63"	1200	1140
19-33	"	04	6"Ø	0.015"	80	90	0.70"	400	370
19-34	"	08	8"Ø	0.04"	160	160	0.70"	800	750
19-35	"	04	6"Ø	0.06"	65	60	0.50"	325	330
19-36	"	04	6"Ø	0.01"	80	80	0.65"	400	390
19-37	"	11	8"Ø	0.03"	100	140	0.30"	510	500
19-38	"	03	5"Ø	0.05"	80	75	0.75"	400	290
19-39	"	04	6"Ø	0.01"	80	80	0.60"	400	350
19-40	"	08	8"Ø	0.02"	160	180	0.80"	800	800
19-41	"	17	10"Ø	0.04"	290	310	0.75"	1450	1340
19-42	"	24	12"Ø	0.03"	215	210	0.35"	1075	1100
19-43	"	04	6"Ø	0.03"	80	70	0.60"	400	350
FLOOR SUMMATION - DES / ACT				**MINIMUM**	**6,555**	**6435**	**MAXIMUM**	**32,620**	**29475**

NOTE: Refer to attached specific comments for noted field issues on these shaded VAV boxes.

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